

3. Reducing Emissions from Energy End Use

Introduction

Greenhouse gas emissions from energy end use include emissions from both stationary and mobile sources.²⁹ In 2003, the industrial, commercial, and residential sectors combined to emit 3,907 million metric tons carbon dioxide (68 percent of total U.S. carbon dioxide emissions)—nearly all from stationary sources (Figure 8). Emissions from stationary sources are produced both directly by the combustion of fossil fuels (e.g., natural gas consumption for home heating) and indirectly from the consumption of electricity (e.g., for commercial lighting). In 2003, the transportation sector accounted for 1,875 million metric tons carbon dioxide, nearly all from mobile sources, and represented approximately 32 percent of U.S. carbon dioxide emissions.

Reducing Emissions from Stationary Sources

Emissions from stationary sources in 2003 included 2,276 million metric tons carbon dioxide from the generation of electricity that was ultimately consumed in the industrial, commercial, and residential sectors. Industry was responsible for the largest share of total stationary-source emissions at 43 percent, followed by the residential sector at 31 percent and the commercial sector at 26 percent.

Between 1990 and 2003, carbon dioxide emissions associated with industrial, commercial, and residential energy use increased by 14.5 percent. Of the stationary sources, the commercial sector has the fastest-growing emissions, registering a 32.0-percent increase in emissions between 1990 and 2003. Emissions from the residential sector increased by 27.9 percent over the same period, and industrial sector emissions declined by 1.0 percent.³⁰

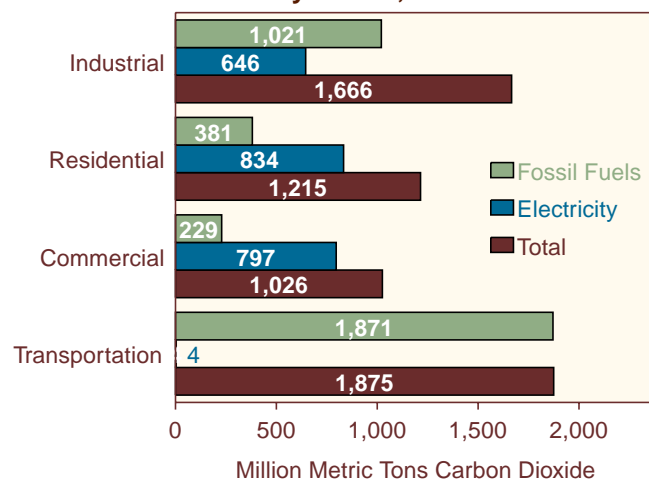
Projects Reported

Reported emission reduction projects affecting stationary sources include fuel switching (e.g., from fuel oil to

natural gas); light bulb replacement (e.g., substituting compact fluorescent bulbs for incandescents); heating, ventilation, and air conditioning (HVAC) system upgrades (e.g., maintenance or replacement with more efficient units); appliance replacement (e.g., retiring old appliances for ENERGY STAR³¹ products); motor and motor drive upgrades; and industrial power system improvements. For 2003, 67 entities reported 374 energy end-use projects on Form EIA-1605 (Table 10). These 374 projects accounted for 19 percent of all the projects reported on the long form.

For the 2003 reporting year, the number of entities reporting energy end-use projects, the number of energy end-use projects reported, and the total reported direct and indirect emission reductions resulting from energy end-use projects all were higher than for the 2002 reporting year (Table 10). Energy end-use reporters increased from 65 in 2002 to 67 in 2003, the number of projects reported rose from 339 to 374, reported direct reductions increased from 24.7 million metric tons to 25.2 million

Figure 8. Sources of U.S. Carbon Dioxide Emissions by Sector, 2003



Note: The industrial sector includes agriculture; the residential and commercial sectors exclude transportation.

Source: Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2003*, DOE/EIA-0573(2003) (Washington, DC, December 2004).

²⁹Stationary sources include emission sources at fixed locations, such as power plants, factories, refineries, mines, and heating plants or waste conversion facilities, among others. Mobile sources include transportation sector emissions from non-fixed locations, such as motor vehicles, aircraft, trains, and ships, among others.

³⁰Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2003*, DOE/EIA-0573(2003) (Washington, DC, December 2004), web site www.eia.doe.gov/oiaf/1605/ggrpt.

³¹ENERGY STAR is a joint program of the U.S. Department of Energy and the U.S. Environmental Protection Agency helping businesses and individuals protect the environment through increased energy efficiency. See web site www.energystar.gov.

metric tons carbon dioxide equivalent, and reported indirect reductions increased from 9.1 million metric tons to 10.0 million metric tons carbon dioxide equivalent.

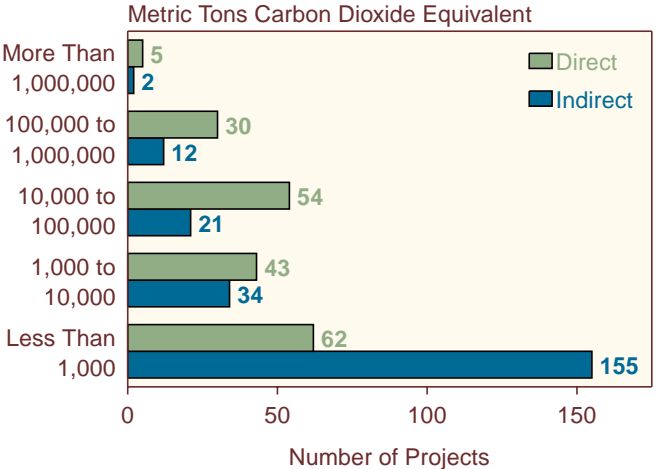
Among the 67 entities that reported energy end-use projects for 2003 on Form EIA-1605, 46 (69 percent) were electric utilities, of which 19 were publicly owned, 26 were privately owned, and 1 was an independent power producer. Companies in the industrial energy end-use sector, comprising 11 percent of all reporters for 2003, included 6 automobile and other transportation equipment manufacturers (9 percent), 5 cement companies (7 percent), 3 pharmaceutical and health care product companies, 2 electronic companies, 2 holding and other investment companies, 1 flood and kindred products company, 1 communications company and 1 oil company.

Emission reductions reported for individual energy end-use projects ranged from less than 1 metric ton to almost 4.2 million metric tons carbon dioxide equivalent, because some reporters included information on each individual end-use initiative separately, whereas others aggregated information on a range of activities into single projects. For example, an electric power distributor may report on a demand-side management (DSM) project that achieves direct emission reductions through multiple supplemental approaches, such as encouraging their residential, commercial, and industrial customers to change light bulbs, temporally shift electric loads, implement urban forestry projects, and upgrade appliances, building shells, and HVAC systems.

Among projects for which direct emission reductions were reported for 2003, 82 percent had reductions of less than 100,000 metric tons carbon dioxide equivalent (Figure 9). Similarly, among projects for which indirect emission reductions were reported, 94 percent had reductions of less than 100,000 metric tons carbon dioxide equivalent. Only seven energy end-use projects reported emission reductions greater than 1 million metric tons each for 2003, which was one less than for 2002.

In terms of emission reductions achieved in 2003, 5 of the 6 largest projects reported were aggregated electric company DSM programs. DSM projects may focus on one or

Figure 9. Energy End-Use Projects Reported on Form EIA-1605 by Size and Type of Emission Reduction, Data Year 2003



Source: Energy Information Administration, Form EIA-1605.

Table 10. Number of Energy End-Use Reporters, Projects, and Emission Reductions Reported on Form EIA-1605, Data Years 1994-2003

Data Year	Number of Reporters	Number of Projects Reported	Emission Reductions Reported (Metric Tons Carbon Dioxide Equivalent)	
			Direct	Indirect
1994	51	160	9,103,753	1,318,092
1995	63	221	12,450,879	1,591,590
1996	62	214	15,288,497	1,538,196
1997	67	249	16,685,010	3,798,030
1998	79	308	18,282,751	5,026,424
1999	80	330	16,047,912	6,786,832
2000	77	382	19,663,333	8,155,193
2001 ^(R)	68	338	19,550,862	7,668,988
2002 ^(R)	65	339	24,707,214	9,061,773
2003	67	374	25,232,544	9,955,603

^(R) Revised data.

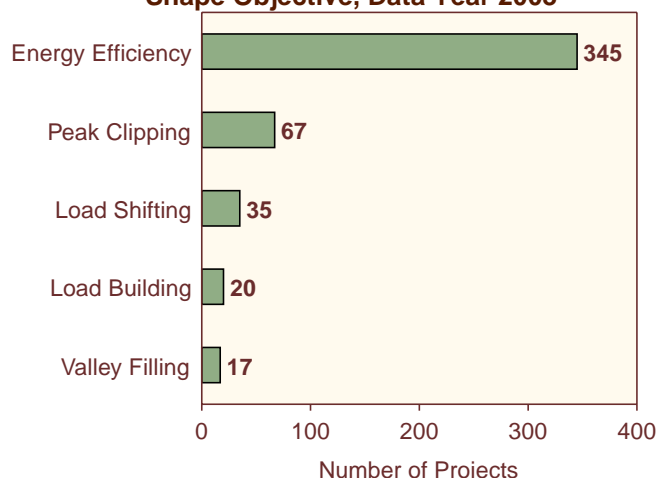
Notes: More than one project type may be assigned to a single project; therefore, the sums of the projects and reductions in each project type category may exceed the total numbers of projects and reductions in the totals and subtotals. Table excludes data from confidential reports.

Source: Energy Information Administration, Form EIA-1605.

more load shape objectives (see box on page 32). Although the most common load shape objective of reported DSM projects for 2003 was increased energy efficiency (345 projects), electric utilities also attempted to balance their load profiles with various other load shape objectives, including peak clipping (67 projects),

load shifting (35 projects), valley filling (17 projects), and load building (20 projects) (Figure 10).

Figure 10. Demand-Side Management Projects Reported on Form EIA-1605 by Load Shape Objective, Data Year 2003



Notes: Some projects may be counted in more than one category. Figure excludes data from confidential reports.

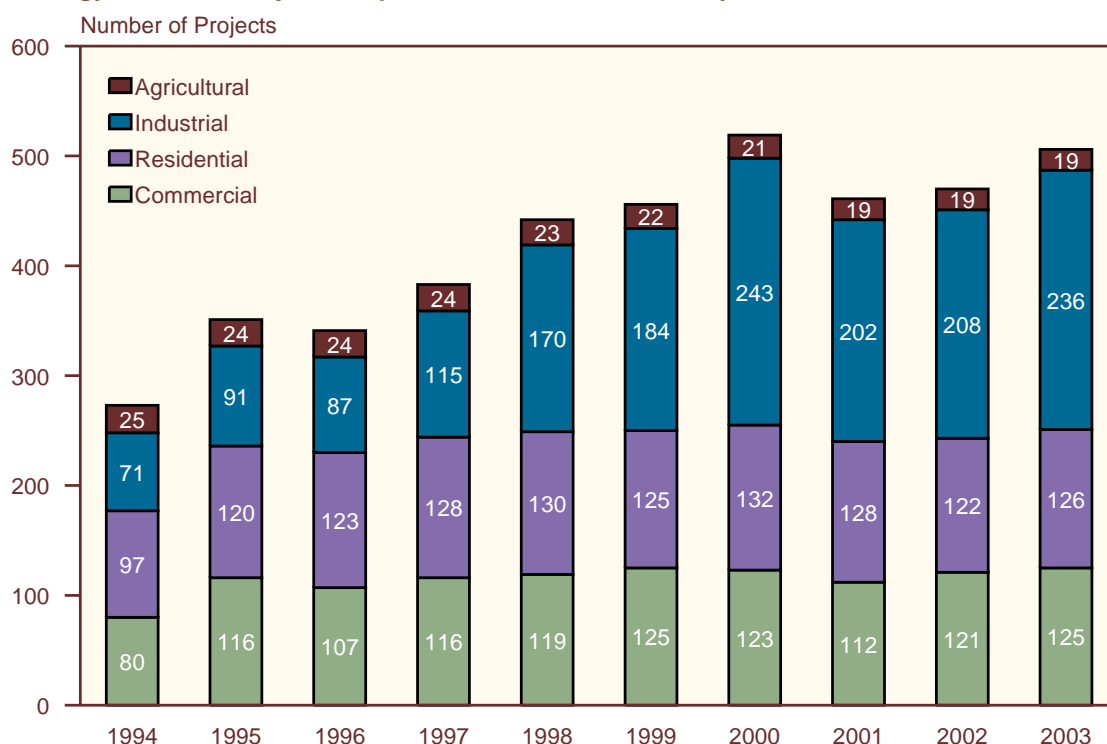
Source: Energy Information Administration, Form EIA-1605.

Energy end-use projects can be carried out anywhere energy is consumed. Reporters indicate whether their energy end-use projects affect emissions in the industrial, commercial, residential, or agricultural sector. For 2003, 236 projects were reported to have reduced emissions in the industrial sector, 126 in the residential sector, 125 in the commercial sector, and 19 in the agricultural sector. More end-use projects were reported for each sector for 2003 than were reported for 2002, except for the agricultural sector. The total number of end-use projects reported was 10 percent above the total for 2002 (Figure 11). It should be noted that many projects—particularly electric company DSM programs—affect more than one end-use sector and are included in each applicable sector for the purposes of counting types of projects reported.

Project Types

None of the 16 new reporters to the 1605b program in 2003 reported energy end-use projects; however, many of the repeat reporters to the program did report new energy end-use projects along with their ongoing projects. Of the 374 energy end-use projects reported, 32 percent (120 projects) involved two or more project types. The most frequently reported type of energy

Figure 11. Energy End-Use Projects Reported on Form EIA-1605 by Sector, Data Years 1994-2003



Notes: Some projects target more than one sector and may be counted in multiple categories. Figure excludes data from confidential reports.

Source: Energy Information Administration, Form EIA-1605.

end-use project for 2003 was equipment and appliance replacement/improvements (157 projects), followed by lighting and lighting controls (153 projects) and HVAC (120 projects) (Table 11). Because of the varied levels of data aggregation in reports by different entities, it is not possible to calculate average emission reductions by project type or to draw conclusions about the most

effective energy end-use project types in terms of total emission reductions achieved.

Equipment and Appliances

Replacements of equipment and appliances with more energy-efficient units (e.g., ENERGY STAR products) to reduce greenhouse gas emissions are frequently

Table 11. Number of Projects and Emission Reductions Reported on Form EIA-1605 for Energy End-Use Projects by Project Type, Data Year 2003

Project Type	Number of Projects Reported	Number of Projects Reporting Emission Reductions			Emission Reductions Reported (Million Metric Tons Carbon Dioxide Equivalent)	
		Direct	Indirect	Both Direct and Indirect	Direct	Indirect
Equipment/Appliances	157	85	94	22	16.9	8.1
Lighting/Lighting Controls	153	78	85	10	20.1	7.8
HVAC	120	69	62	12	19.7	6.1
Load Control	64	40	34	10	14.4	3.6
Building Shell	63	41	29	7	15.7	5.8
Motor/Motor Drive	58	36	31	9	14.4	4.7
Other ^a	31	20	17	6	2.0	0.5
Fuel Switching	26	17	13	4	6.7	1.6
Energy Effects of Urban Forestry . .	8	8	2	2	4.9	*
Industrial Power Systems	4	3	1	0	0.6	0.0
Total	374	194	224	46	25.2	10.0

^aIncludes all projects that cannot meaningfully be included in any of the specific project type categories.

*Less than 0.05 million metric tons.

Note: Project totals and emission reductions do not equal sum of components, because some projects are counted in more than one category.

Source: Energy Information Administration, Form EIA-1605.

Load Shape Effects: Definitions and Terminology

Energy Efficiency. Projects that improve the energy efficiency of specific end-use devices and systems. Such projects usually reduce overall energy consumption, often without regard for the timing of project-induced savings. Generally, energy savings are achieved through the substitution of technically more efficient measures (i.e., equipment, systems, or operating procedures) to produce the same level of end-use service (e.g., lighting or warmth) with less energy use.

Load Building. Projects that increase energy consumption, generally without regard to the timing of the increase. Promotion of residential electric space heating systems and promotion of new industrial electrotechnologies are examples of electricity load-building projects.

Load Shifting. Projects that move energy consumption from one time to another (usually during a single day). For example, water-heater timers typically turn off the

units during the daytime (when an electric company experiences peak demands) and allow the units to operate at night (during the company's off-peak period).

Peak Clipping. Projects that reduce energy demand at certain critical times, typically when the electric system experiences peaks. These projects generally have only small effects on overall energy use but focus sharply on reducing energy use at critical times. Load-shifting and peak-clipping differ because the former shifts much of the energy use from one time to another, whereas the latter eliminates a load without shifting it to another time period.

Valley Filling. Projects that increase off-peak energy consumption (without necessarily reducing on-peak demands). Replacement of an oil-fired furnace with an electric heat pump is an example of valley filling. Such projects can aim to fill daily or seasonal valleys.

reported energy end-use projects. For 2003, no new reporters to the Voluntary Reporting Program submitted reports on equipment and appliance projects; however, a number of repeat reporters submitted reports on new equipment and appliance projects. Exelon Corporation reported 2 new projects for 2003 that increased its efforts to reduce residential energy consumption. Exelon's Low Income Usage Reduction Program has provided \$1.3 million to establish the installation of 150 solar water-heating systems for low-income residential customers with the potential for additional savings on their energy costs. The pilot was extended to allow for an additional 60 installations. The company also incorporated an education component to promote participation, as well as addressing any concern associated with the technology. This project, originally started in 1999, was reported for the first time in 2003. Annual savings for each household are projected to be 82.5 kilowatthours, for a total savings of 17.3 megawatthours of electricity consumption and total emission reductions of 4.4 metric tons carbon dioxide equivalent.

From April 15 through July 15, 2003, Exelon's Clothes Washer Rebate Program offered customer incentives, along with manufacturer's rebates, for a total of \$100 off the purchase of an ENERGY STAR qualified clothes washer. The program, coordinated by the Midwest Energy Efficiency Alliance (MEEA), granted 1,100 rebates to ComEd customers at 110 participating retailers. A typical household does nearly 400 loads of laundry per year, using about 40 gallons of water per full load with a conventional washer. In contrast, a full-sized ENERGY STAR qualified clothes washer uses 18 to 25 gallons per load. ENERGY STAR clothes washers use up to 40 percent less energy and up to 50 percent less water than standard-efficiency washers. They are projected to save as much as 238 kilowatthours and 16 therms³² of natural gas per year when used with an electric dryer and a gas water heater. Potential water savings are estimated at up to 7,000 gallons annually. The projected savings from these 1,100 energy- and water-efficient clothes washers over their expected 12-year lifespan are 371.9 megawatthours of electricity, 36,087 therms of natural gas, and 11.1 million gallons of water. Estimated emission reductions from this project in 2003 totaled 13 metric tons carbon dioxide equivalent.

Lighting and Lighting Controls

Lighting and lighting control projects, such as installing compact fluorescent bulbs and occupancy sensor lighting controls, have consistently been popular projects in the Voluntary Reporting Program. The U.S. Environmental Protection Agency (EPA) Green Lights Utility Ally Program promotes cooperation between utilities and the EPA in publicizing the environmental,

economic, and quality benefits of energy-efficient lighting technologies. Allergan, Inc., has reported to the Voluntary Reporting of Greenhouse Gases Program on its participation in the Green Lights Utility Ally Program. In an ongoing project, existing fluorescent lighting has been upgraded at several Allergan facilities, including 40-watt tubes being replaced with energy-efficient 32-watt tubes, and conventional ballasts being replaced with energy-efficient and/or electronic ballasts. These upgrades are generally conducted in areas undergoing renovation or incorporated into new building designs. This project reportedly reduced the company's overall electricity consumption by 250 megawatthours in 2003, resulting in total emission reductions of 193 metric tons carbon dioxide equivalent.

For 2003, the Estee Lauder Company reported 4 new lighting projects and also, for the first time, reported 11 lighting and lighting control projects that commenced in 2002. Three of the four new projects reported for 2003 involved the installation of new Octron lighting fixtures, consisting of Octron fluorescent lamps, electronic ballasts, and specular reflectors, in place of T-12 fluorescent lamps. The final project was an upgrade from metal halide lights to pulse-start ion metal halide lights. The 4 new projects reportedly reduced the company's 2003 energy consumption by 1,654.9 megawatthours, leading to a reduction in indirect emissions from purchased power of 948 metric tons carbon dioxide equivalent.

Heating, Ventilation, and Air Conditioning (HVAC)

HVAC projects involve the reduced use or upgrade of HVAC systems in homes, businesses, offices, or industrial plants. Although there were no new reporters in the HVAC category, a number of new projects were reported for 2003. The majority of the new projects were not specifically HVAC projects but had HVAC components included in larger DSM efforts.

Both Allergan and the Estee Lauder Company reported new projects that were strictly HVAC. Allergan reported on 5 projects that included upgrades to HVAC system equipment, including a water pump, a cooling water pump, an air handler fan, hot water pumps, and a high-efficiency chiller. These improvements accounted for a total indirect emissions reduction of 667 metric tons carbon dioxide equivalent. The Estee Lauder Company reported on a project that incorporated solar panels into the HVAC system at its Aveda facility. A 1,270-square-foot solar wall system was installed on the high bay south wall, which extends above the lower roof of the office. Fresh air is drawn in through the cladding into a heat pump and distributed in the building through ducting. The preheated ventilation has led to a better standard of indoor air quality and a reduction in energy

³²A therm is equivalent to 100,000 British thermal units (Btu) of energy.

consumption. This project reportedly reduced natural gas consumption by 757.5 million Btu and electricity use by 14.1 megawatthours, leading to total indirect and direct emission reductions of 51 metric tons carbon dioxide equivalent.

Building Shell

Building shell projects improve the energy efficiency of buildings through upgrades to ceilings, walls, floors, windows, or doors (e.g., insulation, air sealing, or efficient materials). A large share of the projects reported in the building shell category for 2003 involved DSM programs by electric power providers. The Platte River Power Authority, a joint action public power utility owned by four Colorado cities (Estes Park, Fort Collins, Longmont, and Loveland) offered Fort Collins a design assistance program. Under this program, Platte River Power Authority paid for a portion of the additional design costs of a high-performance building, based on the recognition that constructing a highly energy-efficient building takes more up-front design time and cost. Daylighting and/or energy-efficiency consultants are often hired to assist in the design process. Customers receiving assistance are expected to achieve at least a 25-percent improvement in energy efficiency relative to a building that meets the current Fort Collins building code.

The methodology used to estimate energy and greenhouse gas savings from building shell projects uses computer models to compare different building designs. In the design phase, computer models are developed to establish a “base” building, which is compliant with the Fort Collins building code, and an “actual” building, which is representative of the high-performance building constructed. Model results were used to estimate the energy use and greenhouse gas emission savings of the new building design relative to the base building, based on actual electric company bills. In 2003, the program led to a reported reduction in electricity use of 508.6 megawatthours and a reduction in indirect emissions of 215 metric tons carbon dioxide equivalent.

Load Controls

Load controls are energy management techniques for minimizing—either overall or at specific times of the day—the load demands on electric power providers. Power companies themselves can use load management options and, through DSM programs, encourage their customers to apply load controls. Independently, power consumers can employ load controls to reduce their energy consumption, shift their demand to non-peak hours, reduce their consumption during peak hours, and reduce energy costs. Load control options include energy efficiency projects, load building, load shifting, peak clipping, and valley filling (see box on page 32).

For 2003, Cinergy Corporation reported a load control project, the Thermal Energy (Cool) Storage Project. Thermal Energy Storage (TES) is designed to reduce summer peak electric loads for space and process cooling applications by shifting those loads to off-peak periods, and to reduce energy use through off-peak system operations. Cooling energy is stored in cooled water, eutectic salts, or ice systems by the operation of electric chillers during off-peak periods and then used during on-peak periods, resulting in a reduction of on-peak electricity demand. Application of off-peak cooling systems can also reduce energy consumption by rejecting heat at lower ambient temperatures.

Cinergy’s target market for its TES program includes schools, churches, and commercial or industrial office buildings, encompassing both new construction and retrofits of buildings that have relatively large cooling needs and operating hours that are conducive to ice-making during off-peak hours. Industrial process applications represent additional market potential for the TES system. The Cinergy program is designed to stimulate the market and help facility owners over the obstacles typically associated with new technologies: cost premiums over conventional HVAC systems; perception that the technology is new and/or complex; and reliability relative to existing systems. In 2003, this project reportedly reduced electricity consumption by 15.8 megawatthours, leading to a direct emissions reduction of 14,272 metric tons carbon dioxide equivalent.

Motor and Motor Drive

High- or ultra-high-efficiency motors and variable-speed or variable-frequency motor drives are more energy efficient than regular motors and motor drives. In addition, controls can be used to reduce electricity consumption by adjusting motor speeds or turning off motors when appropriate. Motor and motor drive projects are generally reported in the commercial and industrial categories, and often they are components of DSM programs, as is the case for all the new motor and motor drive projects reported for 2003.

Allegheny Energy, Inc., reported a motor and motor drive project in 2003 that has been an ongoing effort. Adjustable-speed drives (ASDs) on electric motors have the potential to save energy and demand where motor load is not constant. Allegheny, through its former operating company in Virginia, Potomac Edison, conducted a cooperative research project with an industrial customer and the Electric Power Research Institute (EPRI) to evaluate the use of ASDs on plastic injection molding machines. ASDs were installed on 18 motors for 7 different molding machines. Measured savings were 38 percent for total electrical motor load and 23 percent for total molding machine load. This project represents a good example of DSM activities aimed at industrial

customers. Electricity savings from the project were reported to be 689 megawatthours, resulting in a total emissions reduction of 705 metric tons carbon dioxide equivalent.

Fuel Switching

Switching from high-carbon to low-carbon fuels reduces carbon dioxide emissions generated during combustion. There were no new reporters in the fuel switching energy end-use category for 2003. Minnesota Power continued to report in 2003 on an ongoing project that expanded the use of renewable biomass as a fuel. Minnesota Power operates the M.L. Hibbard / Duluth Steam District No. 2 steam plant for the City of Duluth. The facility provides process steam to a paper mill and a recycled fiber plant. Acceptable fuels at the facility include coal, natural gas, and wood waste. The plant has sought to maximize use of renewable waste wood as a fuel since 1991 and will continue the effort to the extent that appropriate fuel is economically available. When natural gas is economically available, natural gas is also used to reduce consumption of subbituminous coal. Net carbon dioxide emissions from burning wood waste are significantly less than those from burning coal, because the wood waste would otherwise be placed in landfills or left to rot in the field. Hence, Minnesota Power assumes that net carbon dioxide emissions from burning waste wood in this application are zero. Indirect emissions are also significantly reduced, because waste wood can form methane gas under moist, anaerobic landfill conditions (however, avoided methane production from waste wood decay was not reported for 2003).

An additional benefit from the use of wood waste in the M.L. Hibbard / Duluth Steam District No. 2 boilers is that the ash formed during combustion of the wood waste is an agriculturally beneficial product. Potassium and alkalinity in the wood ash make it useful as a fertilizer on farmers' fields. In this manner, most of the Hibbard facility ash produced while burning wood waste is "disposed of" as a substitute for agricultural chemicals. (Again, avoided indirect emissions from this agricultural application of boiler ash were not reported for 2003.)

Minnesota Power also generates electricity at the M.L. Hibbard facility. The high proportion of wood waste burned at the facility results in lower carbon dioxide emissions from Hibbard generation compared to many coal-fired generation alternatives. Minnesota Power sells renewable biomass sourced electricity to Wisconsin Electric Power Company for use in its "Energy for Tomorrow" program. Wisconsin Electric is presuming a net zero carbon dioxide emissions base from its Hibbard renewable biomass energy purchases. In reporting its expanded use of renewable biomass, Minnesota Power increases the heat input from wood waste by the portion

used to generate power for Wisconsin Electric. Minnesota Power, claims no benefit for this renewable generation, allowing Wisconsin Electric to claim the benefit based on avoided emissions from its other power supply resources. For 2003, this project was reported to have reduced coal usage by 812,072 million Btu and direct carbon dioxide emissions by 76,252 metric tons.

Energy Effects of Urban Forestry

Urban forestry is the planting and maintenance of individual trees within a city or community. Urban forestry projects can reduce both carbon dioxide emissions and energy expenditures for urban heating and cooling requirements. General examples of such projects include the planting of shade trees to reduce cooling requirements and windbreaks to reduce heating requirements. Urban forestry projects can also sequester carbon, as discussed in Chapter 4.

There were no new urban forestry projects reported in 2003, although all 8 of the urban forestry projects reported in 2002 continued to be reported, including Pacificorp's Salt Lake City Urban Forestry Project, which has been responsible for the planting of trees in residential areas that will provide shade to buildings and reduce energy use for cooling. Approximately 900 large trees and 400 small trees were planted throughout the project. At maturity, the trees will be between 45 and 75 feet tall. In total, 112 trees were planted around single-family homes with 2 trees per home, 962 trees were planted around single-family homes with 1 tree per home, and 170 trees were planted around multi-family dwellings and a school. The energy savings from this urban forestry program probably would not have occurred in the absence of the program. Although many homeowners plant trees on their own, it is unlikely that they would plant trees to optimize energy savings. For 2003, Pacificorp reported that the project produced direct emission reductions of 106 metric tons carbon dioxide equivalent.

Industrial Power Systems

Industrial power system projects are designed to reduce emissions from industrial power systems through efficiency improvements such as boiler system upgrades and replacements and turbine optimization. There were no new reporters or projects in the industrial power system category for 2003.

Other

There was one new project in the other project type category for the 2003 reporting year. The other project category captures the effects of energy end-use projects that cannot be meaningfully included in another category. Lehigh Cement Company (formerly Lehigh Portland Cement Company) reported a new project that involved the modernization and reconfiguration of its kilns. Two

long-dry kilns were converted to two one-stage pre-heater kilns, which produce more heat and are more energy efficient. This project was reported to have reduced coal use by 376,260 million Btu and direct emissions by 22,854 metric tons carbon dioxide equivalent.

Another project in the “other” category is an investment project reported by Ameren Corporation. The EnviroTech Investment Fund was created to support development and disbursement of energy-efficient technologies. Advent International Corporation manages EnviroTech in cooperation with the Edison Electric Institute. Advent International evaluates and underwrites the development of promising energy efficiency technologies. Union Electric (an Ameren Corporation company) has committed to invest up to \$5 million in this program, which is currently 15.9 percent of the total investments in the EnviroTech Investment Fund. The remaining 84.1 percent of the Fund’s capitalization comes from other participating investor-owned electric utilities. Ameren Corporation reports that it intends to make additional investments in the Fund over the next several years. Sufficient information is not available to describe each type of activity supported by EnviroTech that results in emission reductions.

Reducing Emissions from Transportation

The transportation sector is the largest contributing end-use sector to total U.S. energy-related carbon dioxide emissions, accounting for 32 percent of emissions in 2003. Direct use of petroleum fuels in mobile source applications accounts for 98 percent of transportation sector carbon dioxide emissions, and most of the remaining 2 percent results from the consumption of natural gas. Indirect emissions resulting from the use of purchased electricity account for about 0.2 percent of transportation sector emissions. Carbon dioxide emissions from the transportation sector increased by 19 percent between 1990 and 2003, from 1,570 million metric to 1,875 million metric tons carbon dioxide.³³ The increase was caused by increases in both the average number of miles driven per vehicle and the total number of vehicles

on the road. The average number of miles driven by passenger cars increased by 13 percent between 1990 and 2001,³⁴ and the number of vehicles on the road increased by 22 percent between 1990 and 2001.³⁵ Emissions growth was moderated somewhat by an increase in average U.S. vehicle fleet fuel efficiency from 16.4 miles per gallon to 17.0 miles per gallon between 1990 and 2002.³⁶

For 2003, 66 transportation projects were reported on Form EIA-1605 by 35 entities. All but 5 of the reporters were electric generation companies. One of the non-generators was CLE Resources, a subsidiary of an energy services company; the others were AT&T (telecommunications), The Burlington Northern and Santa Fe Railway Co. (transportation), Blue Source, LLC (emissions offset brokerage), and Arizona Portland Cement. Of the 66 transportation projects reported on Form EIA-1605 for 2003, 61 have been reported in previous years. Five new projects were reported for 2003:

- The Burlington Northern and Santa Fe Railway Co. reported on fuel efficiency improvements, including replacing old, inefficient locomotives, using newer roller bearing technology on rail cars, positioning trailers on intermodal trains to reduce drag, adjusting train speeds to optimize delivery schedules and fuel efficiency, and using friction reducers on the wheel-to-rail interface.
- Blue Source, LLC, an emissions offset broker, reported on the following three transportation actions for which it owns title to the associated greenhouse gas reductions:
 - An empty-mile reduction project conducted by J.B. Hunt Transport Services, Inc.³⁷
 - An idling reduction program initiated by a major trucking company to reduce emissions from unnecessary fuel consumption.
 - An intermodal freight transport project that combines the most efficient aspects of truck and rail modes to carry cargo over long distances. The goal of the project is to expand the transportation of freight by trains, which are more than three times as efficient as trucks on a ton-mile basis.

³³Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2003*, DOE/EIA-0573(2003) (Washington, DC, December 2004), web site www.eia.doe.gov/oiaf/1605/ggrpt.

³⁴Energy Information Administration, *Annual Energy Review 2003*, DOE/EIA-0384(2002) (Washington, DC, September 2004), p. 57, web site www.eia.doe.gov/aer.

³⁵U.S. Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics 2003* (Washington, DC, March 2004), Table 1-11, web site www.bts.gov/publications/national_transportation_statistics/2003/html/table_01_11.html.

³⁶Energy Information Administration, *Annual Energy Review 2003*, DOE/EIA-0384(2003) (Washington, DC, September 2004), p. 57, web site www.eia.doe.gov/aer.

³⁷Empty miles are the miles traveled by a vehicle without cargo between dropoff and pickup locations.

- Consolidated Edison reported on the use of B20, a mixture of 80 percent petroleum diesel fuel and 20 percent biodiesel,³⁸ by at least 122 fleet vehicles.

Of the 66 transportation projects reported for 2003, 35 (53 percent) were affiliated with the Department of Energy's Climate Challenge program.

Tables 12 and 13 show historical trends in the reporting of transportation projects to the Voluntary Reporting

Program. The projects reported for 2003 fall into three broad categories:³⁹

- Alternative fuel use, 31 projects (47 percent)
- Travel reduction, 26 projects (39 percent)
- Vehicle efficiency improvements, 9 projects (14 percent).

Table 12. Number of Projects and Emission Reductions Reported on Form EIA-1605 for Transportation Projects by Project and Reduction Type, Data Years 1994-2003

Year	Number of Projects				Emission Reductions (Metric Tons Carbon Dioxide Equivalent)	
	Vehicle Efficiency	Travel Reduction	Alternative Fuels	Total	Direct	Indirect
1994	3	6	18	26	4,203	6,346
1995	6	14	21	40	22,660	54,061
1996	7	15	26	47	28,813	54,043
1997	9	20	27	55	32,283	95,782
1998	9	23	28	58	25,085	89,174
1999	10	25	30	62	43,499	282,257
2000	9	25	32	64	22,611	134,519
2001	5	21	28	53	44,996	88,023
2002	5	26	30	60	41,966	161,156
2003	9	26	31	66	2,459,095	134,867

Notes: Project totals do not equal sum of components, because some projects are counted in more than one category. Table excludes data from confidential reports.

Source: Energy Information Administration, Form EIA-1605.

Table 13. Emission Reductions Reported on Form EIA-1605 for Transportation Projects by Project and Reduction Type, Data Years 1994-2003
(Metric Tons Carbon Dioxide Equivalent)

Year	Vehicle Efficiency		Travel Reduction		Alternative Fuels	
	Direct	Indirect	Direct	Indirect	Direct	Indirect
1994	1,244	5,651	1,170	—	1,956	695
1995	18,148	36,137	2,179	16,461	2,463	1,495
1996	18,647	38,602	5,427	13,903	4,847	1,546
1997	20,989	48,213	8,753	45,227	2,582	2,352
1998	18,436	70,527	3,110	15,923	3,632	2,746
1999	14,671	174,553	6,077	106,841	22,866	2,148
2000	53	66,324	8,549	67,404	14,021	2,306
2001	-1,109	51,905	13,059	34,050	33,053	2,068
2002	15	48,160	10,920	108,912	31,030	4,085
2003	2,387,335	49,543	38,951	83,156	32,810	2,168

Notes: Table excludes data from confidential reports.

Source: Energy Information Administration, Form EIA-1605.

³⁸Biodiesel is any liquid biofuel suitable as a diesel fuel substitute or diesel fuel additive or extender. Biodiesel fuels are typically made from oils such as soybeans, rapeseed, or sunflowers, or from animal tallow. Biodiesel can also be made from hydrocarbons derived from agricultural products such as rice hulls.

³⁹The sum of projects in each category exceeds the total number of projects, because some projects are counted in more than one category.

The primary effect of the transportation projects reported was to reduce emissions of carbon dioxide. Reductions in emissions of nitrous oxide or methane were also reported for 7 projects. For 18 of the 66 projects reported, either reductions did not occur in 2003 or they were not estimated.⁴⁰

Direct reductions totaling 2.5 million metric tons carbon dioxide equivalent were reported for 30 transportation projects in 2003 (Table 12). This represents a significant increase from the 41,916 metric tons carbon dioxide equivalent in direct reductions reported for 2002. The Burlington Northern and Santa Fe Railway Co. (1.0 million metric tons carbon dioxide) and Blue Source, LLC (1.4 million metric tons carbon dioxide equivalent) reported four new projects that were responsible for the increase.

Indirect emission reductions in 2003 totaling 134,867 metric tons carbon dioxide equivalent were also reported for 24 transportation projects. The sources of the reduced emissions included “fuel cycle” emissions associated with production, refining, transportation, and distribution of fossil fuels; conventional vehicles displaced by customer-owned natural gas vehicles refueled by natural gas distribution companies; employee vehicles affected by reporter-sponsored travel reduction programs, such as carpooling; and railroad-owned locomotives hauling coal in lightweight aluminum rail cars owned by electric utilities. Indirect reductions for 2003 were 16 percent lower than those reported for 2002, due primarily to fewer reductions reported for three projects: an AT&T telecommunication project, a Public Service Enterprise Group employee trip reduction effort, and a TXU carpool program.

Using Alternative Fuels

Of the transportation projects reported for 2003, 47 percent involved alternative-fuel vehicles (AFVs). These projects, however, accounted for only 1 percent of the direct reductions and 2 percent of the indirect reductions reported for transportation projects. In general, the reported reductions for AFV projects were small, with reductions in excess of 1,000 metric tons carbon dioxide equivalent being reported for only one project.

AFV projects involved a variety of fuels, including natural gas, electricity, propane, B20, E85 (a blend of 85 percent ethanol and 15 percent gasoline), and M85 (a blend of 85 percent methanol and 15 percent gasoline).

Electricity was the alternative fuel included in 11 project reports. Southern California Edison’s electric vehicles reportedly logged 1.8 million miles in 2003, more than 10 times the 174,000 miles reported for 1996. The Los Angeles Department of Water and Power (LADWP) reported operating 258 electric vehicles in 2003, up from 204 in 2001 and 18 in 1996. Southern Company reported operating a fleet of 190 electric vehicles in 2003, including cars, trucks, neighborhood electric vehicles, and buses; however, the current size of Southern Company’s electric fleet is less than one-half the 484 vehicles it operated in 2000. Operation of compressed natural gas (CNG) vehicles was reported for 15 projects, and 3 utilities reported operating fleets of more than 100 CNG or dual-fuel CNG/gasoline vehicles⁴¹ in 2003: PG&E Corporation (6,010 vehicles), We Energies (654 vehicles), and NiSource (458 vehicles).

Eight AFV projects reported for 2003 involved fuels other than natural gas and electricity. Activity in 2003 was reported for four of those projects.⁴² Exelon Corporation reported continued use of E85, propane, and B20. Cinergy reported continued use of E85 and B20 in 2003, but it has stopped using propane in company vehicles. Conectiv Delmarva Generation reported using a B20 fuel that included soy-based biodiesel in its fleet vehicles in 2003.

Reducing Vehicle Travel

Travel reduction, which includes such activities as carpooling and vanpooling, mass transit, telecommuting, and service efficiency improvements, was reported for 26 projects for 2003—accounting for 2 percent of the direct reductions and 62 percent of the indirect reductions reported for transportation projects in 2003. The 38,951 metric tons carbon dioxide equivalent of direct reductions reported for 2003 was more than 3 times the 10,920 metric tons reported for 2002. This increase in direct emission reductions was largely attributable to the new project reported by Blue Source, LLC, involving reduction in empty miles traveled by a trucking company. In contrast, indirect emission reductions reported for travel reduction projects for 2003 were 24 percent (25,756 metric tons) lower than those reported for 2002, primarily due to lower reductions being reported for AT&T’s telecommuting program.

Of the 26 projects reported in the travel reduction category, 12 involved carpooling or vanpooling, 9 increased mass transit ridership, 5 reduced employee

⁴⁰In some cases, reductions for the project may have been reported for years before 2003. In other cases, the reductions were not estimated due to the lack of data or other difficulties in quantifying the effects of the project. Entities may elect to report projects without reporting reductions to make a public record of the fact that they have conducted an activity in fulfillment of a commitment made under a voluntary program such as Climate Challenge.

⁴¹CNG dual-fuel vehicles are capable of operating on natural gas or gasoline.

⁴²Two other reporters continued to submit information on projects that involved consumption of propane and M85 in previous years; however, the projects were inactive in 2003.

vehicle use through telecommuting, 4 increased service efficiency for freight or service vehicles, and 9 involved other actions, such as work week compression, video-conferencing, use of bicycles for electric or gas meter reading, promotion of employee commuting by bicycle or walking, and automation of electric or gas meter reading in areas of low population density.⁴³

AT&T reported the largest travel reduction project, a telecommuting program that reportedly reduced indirect emissions by 48,988 metric tons carbon dioxide equivalent. Reductions of more than 5,000 metric tons carbon dioxide equivalent in 2003 were also reported for the following travel reduction projects:

- The Blue Source, LLC, empty miles reduction program reduced direct emissions by a reported 26, 649 metric tons carbon dioxide equivalent.
- LADWP reported on its employee carpooling and vanpooling program (8,167 metric tons carbon dioxide equivalent indirect emission reductions).
- Southern Company reported on its carpooling and mass transit programs (6,040 metric tons carbon dioxide equivalent indirect emission reductions).
- TXU reported efforts to reduce fleet and employee vehicle use (6,556 metric tons carbon dioxide equivalent direct emission reductions and 8,658 metric tons carbon dioxide equivalent indirect emission reductions).
- AT&T reported on its fleet cost reduction program (5,715 metric tons carbon dioxide equivalent direct emission reductions).

- CLE Resources reported its investment, through the Edison Electric Institute's EnviroTech investment fund, in McHugh Software, a company that developed software to improve routing for service vehicles (6,582 metric tons indirect carbon dioxide emission reductions from foreign and domestic sources).

Improving Vehicle Efficiency

Emission reductions were reported for 7 of the 9 vehicle efficiency projects reported for 2003. Indirect reductions were reported for 2 projects, both of which involved the use of light-weight aluminum railroad cars to transport coal. These projects, which were reported by electric utilities, resulted in indirect emission reductions because the locomotives using less fuel were owned by the railroads. Ameren Corporation reported reducing emissions by 21,576 metric tons carbon dioxide equivalent, and Kansas City Power & Light Company reported reducing emissions by 27,967 metric tons carbon dioxide equivalent.

CLE Resources, a subsidiary of Cleco Corporation, continued to report its investment (through the EnviroTech fund established by the Edison Electric Institute) in a company that developed and commercialized a device for monitoring and adjusting tire pressure on trucks to achieve optimal fuel efficiency. CLE Resources did not report emission reductions for this project, due to the unavailability of reliable data on the number of devices sold.

⁴³The total number of travel reduction projects is less than the sum of the projects in each subcategory, because some projects include activities in more than one subcategory.

